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ABSTRACT

Educational institutions and larger public school districts have implemented computerized systems of planning and management functions. The application of computers to facility management roughly may be divided into two general areas: (1) planning efforts of administrators and designers through methods of simulation, and (2) systems management efforts utilizing the computer in a management information role providing feedback on a timely basis to the administrator. By utilizing the computer many information processing tasks can be made possible, providing assistance for decision-making and setting priorities with respect to educational facilities. Inventories, utilization reports, maintenance scheduling, insurance reports, and energy conservation are some of the seemingly routine tasks that may be computerized and made more exacting. (Author/MLF)

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COMPUTER USES IN SCHOOL FACILITY MANAGEMENT

by

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The educational sector of the management world frequently lags behind the commercial and industrial sectors in utilizing techniques which are beneficial to administering programs. The use of computers in helping with facilities management seems to be no exception. Several reasons may be among those causing this phenomena:

(1) High initial cost of setting up computer operations.

(2) Unwillingness for the clientele (the community) to accept this type expense until proven without a doubt that the expense is justified and will conserve other resources.

(3) Lack of knowledge and understanding on the part of school administrators as to application of computers to various management tasks.

(4) Small size of many educational institutions which prevents cost effective application of advantageous management techniques.

Nevertheless educational institutions and larger public school districts have broken the constraints of these causes and have implemented, much to their advantage, computerized systems of planning and management functions. Literature on these applications to the facilities area remains limited in the educational journals. Frequently the best sources for this information are trade journals and commercial firms dealing with hardware or software products.

The application of computers to facility management roughly may be divided into two general areas: (1) planning efforts of administrators and designers through methods of simulation and (2) systems management efforts utilizing the computer in a management

information role providing feedback on a timely basis to the administrator. Other than to identify generally the role of the computer in planning efforts though simulation techniques, this narrative is limited to providing for a management information system in the facilities field.

PLANNING METHODS

The ability to program a computer to perform simulation tasks has benefited the school planner and designer for the last several years. The school planner has been able to utilize models which can simulate curriculum development, st dent loading, staff and facility needs, and financial resources. This has enabled him to determine at what point in time facilities will be required due to population growth. Many details can be included in these models which may or may not suit numerous districts. Modifications in the model can be developed in order to adapt it to a particular district.

Project Simu School is a national effort to develop such models. The National Center of this project is located at the International Headquarters of the Council of Educational Facility Planners, International, Columbus, Ohio. Components of the project are located at Dallas, Chicago, and Santa Clara County, California. At the component districts the models and the software are developed and are then distributed to potential users through the national center (Cornish and Hunt, 1974).

Other simulation programs have been developed which can analyze an instructional program to determine the amount of floor

space required and then test proposed floor plans against the requirements. Others will create floor plans, heating-ventilating-air conditioning systems (HVAC), assist in correcting defects in plans and analyze cost-benefit ratios for the designer (Piele & Wright, 1976). Computerized models also can analyze various designs with respect to energy consumption once the building is completed and help the owner and architect make pre-construction judgements (Energy Saving Designs for Buildings, 1974, p.28). Computer graphics play in important role in this process of testing before building. Potential problems are avoided before they become realities of brick and mortar (Educational Facilities Lab, 1968).

COMPUTER SUPPORT IN MANAGING FACILITIES

Computers are noted for their ability to perform difficult and unique tasks that are virtually impossible to do manually because of the time required or the limitations of the storage resources of the human mind. Frequently the simpler tasks which computers can perform are not considered important; yet these have the widest range of application, may save countless hours or provide information feedback to the administrator who in the past has made decisions without this information. With soaring costs and limited resources, the administrator can no longer afford less than the best decisions.

Utilizing the computer many of these information processing tasks can be made possible, providing assistance for decision making and setting priorities with respect to educational facilities. Inventories, utilization reports, maintenance scheduling, insurance reports, and energy conservation are some of the seemingly routine

tasks which may be computerized and made more exacting.

Inventories

The basic element in a facilities management information system is the building inventory. "This is a statistical description of all buildings owned or rented including both building and room data" (Murphy, 1975, p.34). Included is a room-by-room listing which details characteristics of assignable space such as departmental use, number of stations, floor space, seating, etc. (see figure 1). Also information on corridors, restrooms, stairwells, mechanical equipment rooms, and any other peripheral areas must be detailed because of the need for setting operations and maintenance schedules.

Every element inventoried is numbered for the system. In many cases this will necessitate renumbering the buildings and rooms because of duplicate numbers, missing numbers or poor sequencing. At the time of initial inventory, rating capacity must be set according to a set of formulae based on size, use, special equipment and program. Also established should be teaching stations, types of seats or desks, and special equipment as TV, screens, projectors, etc. Types of air conditioning equipment also must be documented for maintenance purposes.

From such a listing cleaning and maintenance schedules may be developed. Utilization reports can be built from the class schedule and enrollment files which would also be computerized. Such a report for one instructional area is included in figure 1. From this report it can be determined that the room use rate is 68%

TIME	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
09 00	80		80		80
09 15	A		A		A
09 30	A	47	A	47	A
09 45	A	B	A	B	A
10 00	83	B	83	B	83
10 15	C	B	C	B	C
10 30	C	B	C	B	C
10 45	C		C		C
11 00	34	76	34	76	34
11 15	D	E	D	E	D
11 30	D	E	D	E	D
11 45	D	E	D	E	D
12 00	25	E	25	E	25
12 15	F		F		F
12 30	F	37	F	37	F
12 45	F	G	F	G	F
01 00	45	G	45	G	45
01 15	H	G	H	G	H
01 30		G	H	G	H
01 45	H		H		H
02 00	32	15	32	15	32
02 15	I	J	I	J	I
02 30	I	J	I	J	I
02 45	I	J	I	J	I
03 00		J		J	
03 15					
03 30	14		14		
03 45	K		K		
04 00	K		K		
04 15	K		K		
04 30	K		K		
04 45					

WEEKLY STUDENT CONTACT HOURS	1369.50
WEEKLY ROOM HOURS	30.50
AVERAGE SECTION SIZE	44.90

Building	076 Symons Hall
Room	00200
College	99
Division	
Department	Univ
Calculated Stations	109
Present Stations	109
Assigned Sq Ft	1,195
Room Use	110C Lecture
Type of Seating	Wooden Tablet-Arm Chair
Air Conditioning	Window Unit
Audio-Visual	Screen/Projector
Television	No

INSTRUCTOR CODE	INSTRUCTOR NAME	COURSE ABBR	COURSE NUMBER
A	SCHACT	ANTH	241
B	POIST	BSAD	370
C	BAKER	HORT	271
D	MILLER	ENGL	241
E	SHANKS	HORT	231
F	COHEN	ENGL	101
G	DWYER	ENGL	222
H	GARNER	BSAD	370
I	ROCKWELL	ENGL	201
J	SMITH	ENGL	102
K	BEAL	AREC	432

Figure 1

Room description and utilization report
(Murphy, 1975)

in the case cited which is good for a university situation; however station utilization (actual student enrollment in assigned classes as compared with available capacity) is only 28%. As a result of this report, if more student capacity is required at certain times during the day this room may be reassigned.

Also inventoried and maintained by the computer on files which are updated regularly are the equipment holdings of the school. Exactly what is included here would be determined by law and the needs of the administration. Usually this would include all office equipment, audio visual equipment, and other items requiring periodic or preventive maintenance such as motors, compressors, boilers, air conditioners, vehicles, etc. As part of the data base an equipment number would be assigned to each item and attached to it physically by means of a small metal label. Location and condition should also be noted. This inventory of all items will assist in an audit and for budgeting purposes.

Periodic Maintenance

Along with the above information on equipment, maintenance requirements for each item should be maintained on the file. This includes all regular periodic or preventive maintenance checks which should be performed such as:

(1) Visual checks: look-see check for obvious problems

(2) Cleaning: wiping dust, dirt, grease, etc. from machine

(3) Functional check: close inspection to determine if equipment is operating normally

(4) Lubrication: regularly scheduled as recommended

(5) Service: close inspection with adjustment or replacement of needed items being made

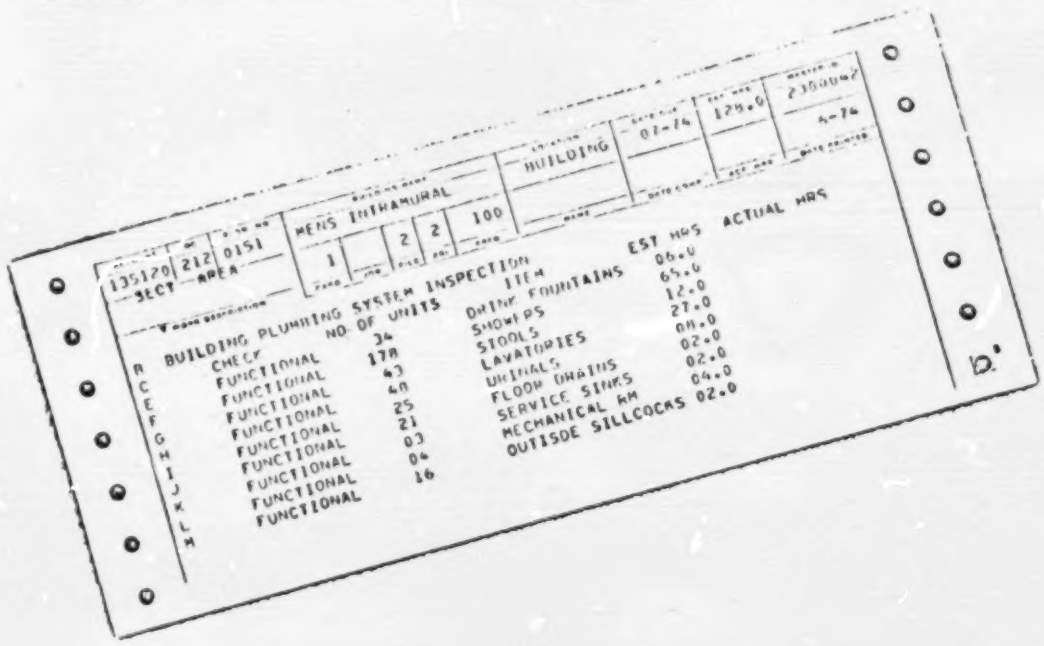
(6) Vibration check: check with a vibration meter

Frequency of each of these checks on various equipment must be established through use of service manuals and field experiences of qualified personnel. The frequency should be based on operating hours rather than time intervals where applicable such as on pumps and motors. This will help to conserve maintenance time on machinery which runs infrequently (Computer Programed Preventive Maintenance, 1973, pp.73-75). After each maintenance function is classified by skill level the data is transferred to the file.

Weekly or monthly the computer prints out job orders which are distributed to maintenance supervisors who assign tasks based on time required to complete them (see figure 2). After completing the checks and necessary tasks the job orders are turned in and the job file is updated so the check is scheduled at the proper time it is due again. High priority checks are scheduled first. Maintenance reports are printed each month as needed by the computer.

Building such a job file will enable the school plant administrator to gain control of the maintenance function and conserve on resources. This will improve supervision and ultimately save money (Lammers, 1974). Michigan State University reduced square footage maintenance costs in a two-year period despite a 5.5% wage increase by using such a system and improving manpower utilization. In addition complaint calls were reduced considerably, cost reductions on maintaining specific operating equipment were realized, and energy consumption was reduced (Wilson, 1974, p. 32).

JOB TICKET PRINTED BY COMPUTER



Once each month, job tickets are printed by the computer and distributed to the proper supervisor who, in turn, passes them on to the workers.

Term	Explanation
Account	M.S.U. account designation, i.e. 13 = Current Funds; 5120 = Plumbing
OC	Object Classification—An "in house" breakdown of work assignments. At year-end, by tabulating the above, the operation can be analyzed as to major account (electrical, plumbing, heating, etc.) further broken down by the various object classifications for each building on campus.
Master ID	Coding identification, i.e. 23 = Craft Identification; 00042 = Job Number
Card	Sequential number given to cards on each print-out.
File	Skill level.
PRI	Priority.
Frequency	100 = Once a year.
Functional Check	A close inspection of equipment to make sure that it is operating normally. M.S.U. has six types of checks, as explained in the article.

Figure 2

Job assignments as printed by computer
(Wilson, 1974)

In addition to scheduling the maintenance tasks, the computer will provide information on the operating equipment which may be used to evaluate the standards for frequency of maintenance. In this way new standards may be set, therby saving additional resources. Spare parts for replacement can also be stocked based on this information (Computer Programed Preventive Maintenance, 1973).

Energy Conservation

Within the past several years environmental factors within facilities have become computerized to assist in both an energy savings program and a maintenance management program. Most importantly savings have been realized by reducing consumption of high cost energy. As a major side benefit of the process equipment is monitored on a continuing basis for problems, thereby eliminating breakdowns, saving manpower and extending equipment life. The data which is gathered in this process provides an analytical tool for equipment management purposes.

Originally buildings may be analyzed for energy consumption requirements in a technical manner which includes many other energy/thermal variables such as lighting, pupil occupancy requirements, heat losses and gains, solar exposures, weather variations, and thermal load demands. This information is particularly beneficial when building new facilities or replacing HVAC equipment in a recycled facility. From the data gathered and simulated by the computer, choices may be made concerning available alternative equipment (Merkler, 1975, pp.44-46).

Once installed the HVAC system may be operated under the direction of a computer program which takes into consideration all of the above thermal variables when activating the various components. For example instead of utilizing fresh air fans at a constant rate throughout the day, they would be activated only when student occupancy levels required them. This is turn maintains temperatures at desired levels without calling for more heat from the boiler

system--thereby conserving energy.

The system itself is operated from a control center through a keyboard accepting English instructions. Output is also in English via a video tube or printer. Cost for computer, control center and wiring in 1975 averaged 38¢ per square foot of building space for buildings ranging from 15,000 to 500,000 square feet (Caffrey, 1976, p.52).

Schaumburg High School, Schaumburg, Illinois, reduced its energy consumption by $28,000 for the year when it placed its HVAC system under computer control in 1973. Instead of purchasing or leasing a computer, the district tied into a computer system 20 miles away which specialized in automatic remote control of building mechanical systems. Costs were $14,000 for the year including leased telephone lines and a $12,000 one-time connection charge. Costs of installation and operation were offset in the first year and thereafter a 100% profit return for the investment could be realized. See figures 3 and 4 for energy usage comparison (Computer-controlled HVAC, 1974, pp. 24-25).

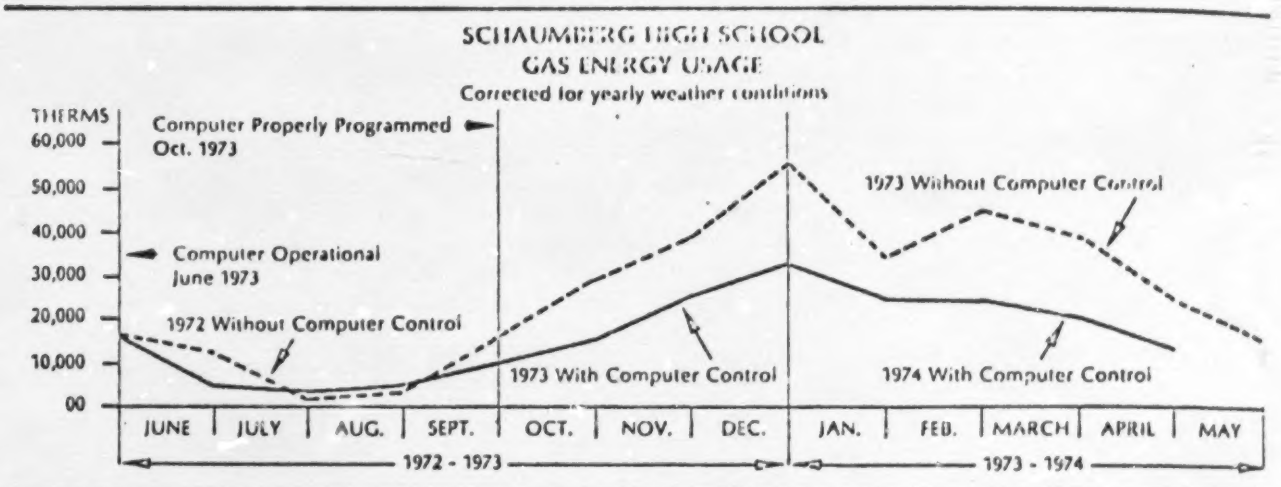


Figure 3

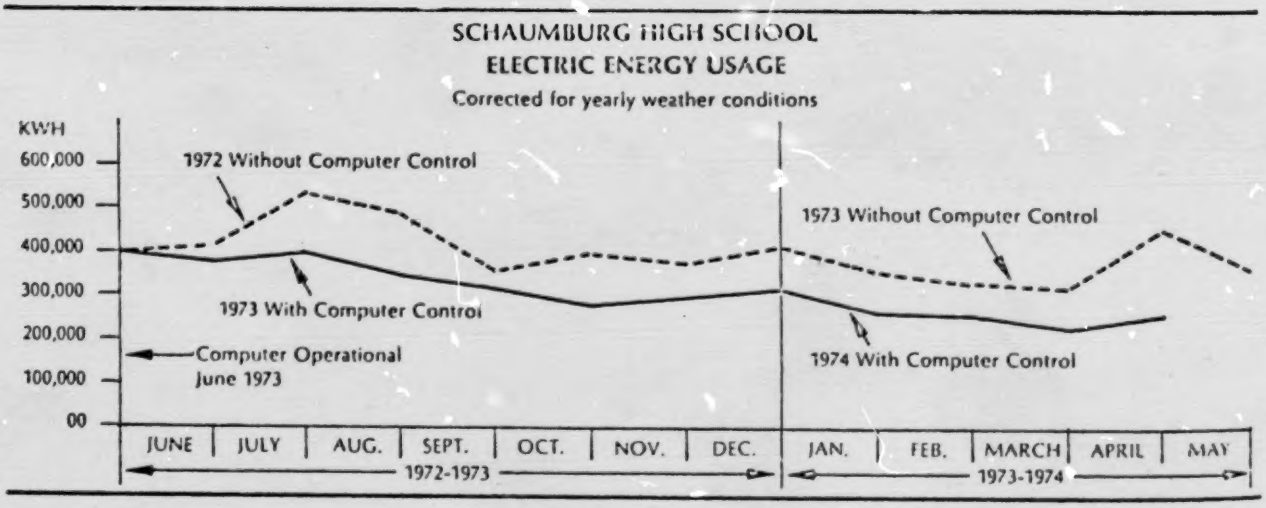


Figure 4

Both Honeywell's Commercial Division in Minneapolis and Johnson Controls of Milwaukee have computerized systems designed to carry out these tasks.

THE DECISION TO COMPUTERIZE

It is obvious that every educational institution and public school district cannot financially afford to computerize all of these functions. The cost compared to the financial benefits received are prohibitive to many districts; however even the small district can computerize inventories more accurately and easier than by manual means. Size of the management task is an important criteria for other functions. When work volume reaches the point where it is difficult to maintain necessary maintenance checks, it is time to utilize the computer. Whenever financial benefits are apparent to the administrator, he must develop the system. Financial benefits can stem from more than one source and all

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